Northumbria Research Link

www.northumbria.ac.uk/nrl

northumbria
UNIVERSITY NEWCASTLE

An eye-tracking examination of readers' sensitivity to pragmatic scope information during the processing of conditional inducements.

Jeffrey S. Wood[1]

Matthew Haigh[2]

Andrew J. Stewart[3]

[1]Dept of Psychology, School of Social Sciences, Faculty of Business, Law & Social Sciences, Birmingham City University, Curzon Building, Cardigan Street, Birmingham, B4 7BD, UK.

[2]Department of Psychology, Northumbria University, Newcastle upon Tyne, NE1 8ST, UK.

[3]Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, M13 9PL, UK.

Address for correspondence:

Jeffrey S. Wood,

Tel: +44 (0)121 331 5000

jeffrey.wood@bcu.ac.uk

Tel: +44 (0)191 227 3472

matthew.haigh@northumbria.ac.uk

Tel: +44 (0)161 275 7331

andrew.stewart@manchester.ac.uk

Abstract

Previous research into conditional inducements has shown that readers are sensitive *after* reading such conditionals to pragmatic scope differences between promises and threats; specifically, threats can be referred to as promises, but promises cannot be referred to as threats. Crucially, previous work has not revealed whether such scope effects emerge while processing the conditional *itself*. In the experiment reported here participants' eye-movements were recorded whilst they read vignettes containing conditional promises and threats. We observed a reading time penalty on the conditional itself when participants read a conditional promise that was described as a "threat" (e.g., *Liam threatened Perry "if you tell dad, then I'll take equal responsibility"*). There was no such penalty when the word "promise" was presented before a conditional threat. These results suggest that readers are sensitive during reading of the conditional itself to pragmatic scope differences between "threats" and "promises".

Key Words: conditionals; speech acts; inducements; experimental pragmatics; discourse processing

Word count: 4149

During reading, we show that conditional statements containing either positive and negative outcomes (e.g., "If you tidy your room, then I'll let you go out tonight" and "If you don't tidy your room, then I'll ground you") can both be seen as a type of promise. However, only the latter can be seen as a type of threat. The interpretation of conditionals is an important topic given their widespread usage in areas such as health, legal, and everyday settings.

Introduction

Understanding conditionals of the form *if p, then q,* is an important research endeavour given that conditional usage is so ubiquitous; conditionals are used widely across the health, legal, political, and social domains. Traditionally, psychological research on conditionals has focused on the inferences and conclusions that are drawn offline after the reading of *basic* conditional statements (e.g., if there is a circle, then there is a triangle). Such conditionals lack contextual and pragmatic information (see Evans & Over, 2004; Johnson-Laird & Byrne, 2002). Recently, there has been an increasing focus towards experimentally investigating the moment by moment comprehension of contextually rich conditionals, which can only be understood through the use of real world context and pragmatic knowledge (e.g., Ferguson & Sanford, 2008; Haigh, Ferguson, & Stewart, 2014; Stewart, Haigh & Ferguson, 2013; Wood, Haigh & Stewart, 2016). This emergence of a new literature on conditionals coincides with a broader move in psycholinguistics towards studying the pragmatic features in language and how they influence language usage (Noveck & Reboul, 2008).

Following Grice (1975), Noveck and Reboul (2008) argue that in order to fully understand an utterance the addressee needs to be sensitive to the communicative intention of the producer. This requires the addressee to be sensitive to the pragmatic context in which the utterance occurs. Indeed, there has been a range of evidence produced in recent years showing that readers are sensitive to pragmatic context and this is used to draw inferences in conversations (e.g., Lea, Kayser, Mulligan & Myers, 2002; Lea, Mulligan & Walton, 2005). In the context of conditionals, understanding the intended meaning requires the addressee to be sensitive to a range of pragmatic factors. This is particularly true in the context of conditional inducements (i.e., conditional promises and threats). Take, for example, the following conditional: *"if you go out tonight, then I'll buy you a drink"*. Here the producer's intended meaning is to offer a promise as a means to persuade the addressee to go out. It is

possible to make the speaker's intended meaning explicit by including the speech act within the utterance, *"if you go out tonight, then I promise I'll buy you a drink"*. However, speakers often do not explicitly state their intended meaning (Holtgraves, 2008). Indeed, for threats it is not possible to include a performative verb in this way (Searle, 1976; Searle & Vanderveken, 1985); consider how anomalous the following sounds *"if you go out tonight, then I threaten I'll break up with you"*. In order to understand conditionals that lack a performative verb, the addressee needs to infer the speaker's intended meaning (e.g., a request for the addressee to not go out that night).

In his decision-theoretic utility grid framework, Bonnefon (2009) formalised two key cues necessary in understanding the meaning conveyed in a conditional inducement. The first of these is whether the speaker has control over the consequent event (e.g., [using the previous conditional] breaking up with the addressee). Inducements are always under the speaker's control; this is not the case for advice (i.e., tips and warnings). Sensitivity to speaker control during the online comprehension of conditionals has been demonstrated by Wray, Wood, Haigh and Stewart (2016) in threats and warning, and in promises and tips by Stewart et al. (2013). Stewart et al., monitored participants' eye movements during the comprehension of conditional promises and tips. They found a significant effect of speaker control on the processing of conditional promises. When the speaker did not have control over the consequent event (and so was not in a position to utter a promise) there was (a) an increase in the number of regressive eye movements and (b) an increase in processing times for the consequent of the conditional, relative to when the speaker did have control over the consequent event. This provides good evidence that pragmatic information related to speaker control plays a role in the online comprehension of conditional promises.

The second important cue proposed by Bonnefon (2009), following earlier work by Searle (1969), is the polarity of the outcome for the addressee. The consequents of both

conditional promises and threats need to be under the speaker's control. However, they differ in the polarity of the utility to the addressee of the outcome. For example, a conditional promise uttered by a boyfriend to his girlfriend (e.g., *"if you go the pub, then I'll come with you"*) provides a consequent that has positive utility for the addressee (assuming his girlfriend wants his company tonight). Indeed, according to Searle (1969) positive polarity (utility) is one of the key components that makes a statement a promise. In contrast, a conditional threat (e.g., *"if you go the pub, then I'll break up with you"*) provides a consequent that has negative utility for the addressee (assuming the addressee does not want to break up with her boyfriend). Haigh et al. (2014) used eye-tracking to investigate whether readers are sensitive to the polarity of the utilities of conditional consequents during reading. They used short vignettes to set up a context whereby readers would expect the following conditional consequent to have either positive or negative utility. Readers saw one of two contexts for each item (e.g. "*The Editor was very impressed by Alan's findings and said that they should be widely publicised." vs. "The Editor was very critical of Alan's findings and said that they were not valid.*"), before being presented with a conditional containing a consequent with either positive or negative polarity. These conditionals of differing polarity thus represented either a promise or a threat (e.g., "*As they parted, the Editor told Alan 'if you submit your paper to the Journal of Physics, then I will accept it outright". vs. "As they parted, the Editor told Alan 'if you submit your paper to the Journal of Physics, then I will reject it outright*"). Haigh et al. found that whenever the polarity of the conditional consequent did *not* match the expected polarity set up in the context, there was (a) an increase in the number of regressive eye movements both into and out of the consequent region as well as (b) an increase in processing times for the consequent. The findings of both Stewart et al. (2013) and Haigh et al. (2014) show that readers are sensitive during reading to both of the utility cues detailed in Bonnefon's (2009) utility grid framework.

As well as the utility grids of promises and threats differing in respect of their polarity, other pragmatic differences exist. Previous work looking at conditional promises and threats has shown that readers feel promises incur a greater obligation to be carried out than threats (Searle & Vanderveken, 1985; Verbrugge, Dieussaert, Schaeken & Van Belle, 2004). A speaker, therefore, has a greater onus placed on them following a conditional promise (e.g., *"If you sing like you did in the last round, then I'll award you first prize"*) to carry out the action in the conditional consequent (e.g., *awarding first prize*) when the addressee completes the action described in the antecedent (e.g., *singing well*). Recognition of the differing strength in the obligation of promises and threats is shown in the colloquialism *"That's not a threat, that's a promise"*. Here the speaker reformulates a threat as a promise in order to strengthen the perception that the consequent action will follow the antecedent by drawing upon the greater obligation associated with a promise. This reformulation indicates that promises can encompass inducements with either negative or positive polarity. By contrast, as the level of obligation is weaker for threats it would make no sense to reformulate a promise as a threat. This would suggest threats can only have negative polarity. Promises and threats, therefore, differ in the relative pragmatic scope associated with them (e.g., promises have a greater scope than threats). Note, in this paper *scope* is used to refer to the how encompassing the terms promise and threat are for items of differing polarity, rather than to logical scope (Over, Douven, & Verbrugge, 2013).

The effect of differences in the pragmatic scope of promises and threats in online comprehension was examined previously by Haigh et al. (2011) and Wood et al. (2016), using self-paced reading and eye-tracking respectively. Both Haigh et al. (2011) and Wood et al. (2016) examined the influence of pragmatic scope on the processing of an anaphoric reference to conditional promises and threats (see Example 1).

Example 1

> Last night Perry and Liam borrowed their dad's car without asking. Unfortunately
> Perry managed to reverse the car into a garden wall and crack the rear bumper. In
> deciding what to do Liam said to Perry "if you tell dad, then I'll take equal
> responsibility" (Promise). / "if you tell dad, then I'll tell him it was your fault"
> (Threat). This promise/This threat left Perry feeling no better. The car was not
> even a year old.

The studies of Haigh, et al. (2011) and Wood et al. (2016) found evidence of a processing penalty that was asymmetric in nature. When the anaphoric noun "threat" in the penultimate sentence was used to refer back to a conditional promise, there was a processing penalty (i.e., a slowdown in reading); however, when the anaphoric noun "promise" was used to refer to a conditional threat, there was no such penalty. Crucially, using the more temporally sensitive method of eye-tracking, Wood et al. (2016) showed that when readers are able to access the pragmatic scope information associated with the conditional meaning *before* they became sensitive to utility (mis)matches between the utility of the conditional and the anaphor. This provides initial evidence that pragmatic factors such as the relative scope of promises and threats play an important early role in conditional processing.

The work discussed so far examined either the pragmatic cues that are important in the comprehension of utility conditionals (Haigh et al., 2014; Stewart et al., 2013) or looked only at the comprehension of the pragmatic meaning in conditional promises and threats *following* a conditional (i.e., processing of a subsequent anaphor, Haigh et al., 2011; Wood et al., 2016). The data reported to date do not reveal whether sensitivity to pragmatic scope differences between promises and threats actually occur *during* reading of conditionals. For instance, there is good evidence from the discourse processing literature that the

comprehension of anaphoric expressions involves separate stages of processing; with full resolution occurring only after an anaphor is linked with possible antecedents and then checked against the ongoing discourse model (e.g., Garrod & Terras, 2000; Sanford, Garrod, Lucas, & Henderson, 1983). It is during these processes of resolution that the influence of pragmatic information is likely to be at its strongest. Thus, the results of Haigh et al. (2011) and Wood et al. (2016) may reflect both the influence of the pragmatic factors associated with processing of the conditional inducement but also those processes which are required to resolve the anaphor. It is also not possible to be certain that the effects shown in Haigh et al. (2011) and Wood et al. (2016) do not reflect readers making a *backwards inference* upon encountering the anaphor. It is, therefore, not possible, on the basis of the studies to date, to determine whether sensitivity to pragmatic scope occurs as a conditional itself is encountered. This issue requires resolution for a fuller understanding of conditional meaning and how it is mentally represented during reading.

<u>Experiment</u>

In our experiment, we use eye-tracking to examine the processing of conditional inducements. These inducements were adapted from Haigh et al.'s (2011) original offline categorization task. These items were independently classified as promises and threats, from a choice of promise, threat, warning, tip or other, by 81% and 74% of participants in this offline categorization task respectively. However, in the present study the conditional inducements were adapted to describe a consequent that (mis)matches the meaning of a preceding verb meaning (see Example 2 below). This contrasts with the studies of Haigh et al. (2011), and Wood et al. (2016) which focused on processing for an anaphor *following* a conditional inducement. For the reasons outlined above, such findings may tell us more about

anaphoric resolution in the context of inducements than they do about how conditional

inducements are understood when they are read.

Example 2

> Last night Perry and Liam borrowed their dad's car without asking. Unfortunately
>
> Perry managed to reverse the car into a garden wall and crack the rear bumper. In
>
> deciding what to do Liam promised/threatened Perry "if you tell dad, then I'll take
>
> equal responsibility". / "if you tell dad, then I'll tell him it was your fault". This
>
> left Perry feeling no better. The car was not even a year old.

In order to understand how conditional processing is informed by pragmatic scope

factors, it is important to determine how pragmatic scope (whether promises can encompass

both positive and negative outcomes for the listener) affects the comprehension of a

conditional itself when it is encountered. Previous research has demonstrated that utility grid

based information (i.e., *who* controls the consequent and whether this leads to a positive or

negative outcome for the listener) influences processing of a conditional when it is

encountered (Haigh et al., 2014; Stewart et al., 2013). If utility grid based information (and

not scope information) is activated while conditionals are read, then following Haigh et al.

(2014) we would expect to find a processing cost emerging on reading of the consequent

clause of conditionals for conditions where the verb meaning and the conditional meaning (as

indexed by the consequent utility) *mismatch* (i.e., when the verb meaning "promise" is

followed by a conditional threat, and when the verb meaning "threaten" is followed by a

conditional promise). This would be reflected as a *symmetric* interaction effect whereby *both*

mismatching conditions result in a processing cost (i.e., a slowdown in reading). However, if

the pragmatic scope differences between promises and threats are able to influence

comprehension when the consequent of a conditional is encountered, we would expect an effect to emerge that will be similar to the *asymmetric* pattern that was reported in Haigh, Stewart et al. (2011) and Wood et al. (2016). This would be reflected as a processing cost for a conditional promise following the use of the verb *threaten*, but no processing cost for a conditional threat following the use of the verb *promise*.

Method

Participants

Thirty two native English speakers from the University of Manchester were recruited via opportunity sampling. The experiment lasted around 45 minutes and each participant was compensated with either £5 or partial course credit.

Design and materials

The experimental items were 32 vignettes (see Appendix). Each vignette was five sentences long. The first two sentences provided context. The next sentence contained the verb meaning (promised / threatened) followed by a conditional. This sentence was manipulated so that the speaker uttered either a conditional promise or a conditional threat. The final two sentences contained additional contextual information.

This resulted in a 2 (Verb Meaning) x 2 (Conditional Meaning) repeated measures design, with four conditions (see Table 1).

*******************Table 1 here*******************

There were four versions of each item (128 permutations in total). Using a Latin-square design the vignettes were split into four lists with each participant seeing eight experimental items from each condition. Each list also contained 16 filler passages made up of several sentence long short stories which did not contain conditionals (e.g. *As Suzanne left her house she looked up at the sky. There were a number of very dark clouds. It looked like it was going to be another day for the umbrella. This weather was really starting to get beyond a joke.*). Eight participants were randomly assigned to each list. The lists contained 32 experimental items interspersed with 16 filler items. Comprehension questions followed 25% of the items. This study was approved by the University Research Ethics Committee at the University of Manchester.

Procedure

An Eyelink 1000 in the desktop mount configuration was used to record eye movements. Head position was stabilised using a chin and forehead rest. Viewing was binocular and recordings were sampled from the right eye at 1,000Hz. The vignettes were presented in size 22 Arial font on a LCD monitor 60 centimeters from the participants' eyes. Each character subtended 0.741° of visual arc. The eye-tracker was calibrated using nine fixation points. Participants were instructed to read at their normal reading rate for comprehension. Each trial appeared after the participant fixated on a gaze trigger. After reading the vignette participants pressed a button on a handheld controller to reveal either a comprehension question or the next trial.

Data analysis

We analysed one region of interest, which was the consequent clause of the conditional (see Table 1). An automatic procedure pooled fixations shorter than 80 msec. with adjacent

fixations. It also excluded fixations that were shorter than 40 msec. if they were not within three characters of another fixation and truncated fixations longer than 1,200 msec.

We analysed four processing measures (see below for definitions). The first two provide information about processing as a region of text is first encountered (1-2), with the third (3) containing information from both early and intermediate processing. The final measure (4) accounts for both early and later processes, as a region of text is revisited.

1. *First pass reading time* is the sum of all the fixation durations in msec. from the eye first entering the region until first exiting either to the left or right.

2. *First pass regressions out* is the percentage of trials in which regressive saccades were made from the current most rightward fixation into an earlier region.

3. *Regression path reading time* is the sum of all fixation durations in msec. from the eye first entering a region until first exiting the region to the right (including all re-reading of previously read text).

4. *Total reading time* is the sum of all fixation durations in a region in msec.

Analyses of effects were performed by fitting linear mixed models (Baayen, Davidson, & Bates, 2008) for the reading time measures (with lsmeans [Lenth & Hervé, 2015] used to generate pairwise comparisons), using the *lme4* package (Bates, Maechler, Bolker & Walker, 2015) in *R* (R Core Team, 2015), and logit mixed models for the binomial measure (Jaeger, 2008). Analyses were carried out using Verb Meaning, Conditional Meaning and the interaction between these factors as fixed factors and subjects and items as crossed random factors (Baayen et al., 2008). We used the maximal random effects structure where possible: random intercepts for subjects and items, as well as by-subject and by-item random slopes on all fixed factors in the model (Barr et al., 2013). This was the case for all analyses on the

reading time measures. For the binomial measure of first pass regressions out, this structure did not converge and so separate by subjects and by items models using only random intercepts and Verb Meaning as a random slope were constructed. However, for the pairwise comparisons on first pass regressions out a single model using Verb Meaning as a fixed factor and by subjects and by items random intercepts and slopes successfully converged. When presenting the results of the linear and logit mixed models results we report regression coefficients (b), standard errors (SE), and t-values (for duration measures) or z-values (for the binomial measure) using restricted maximum likelihood estimation. Absolute values of the t-value and z-value greater than or equal to 1.96 indicate an effect that is significant at approximately the .05 alpha level. For the pairwise comparisons on the reading time measures (first pass, regression path and total time) we report the t-values and Bonferroni corrected p-values corrected for the two theoretically motivated comparisons. The key comparisons were always between lexically identical regions of text.

Results

The means for each eye movement measure are displayed in Table 2 and the results of the Linear Mixed Models are reported in Table 3.

******************Table 2 here******************

******************Table 3 here******************

There were no significant effects found for the first pass reading times. However, there was an interaction between Verb Meaning and Conditional Meaning on first pass regressions out for the consequent region. Pairwise comparisons on this measure then revealed that this interaction was *asymmetric*. When Conditional Meaning mismatched Verb Meaning there was an increase in first pass regressions out of this region for conditional promises (39% vs. 16%, b = -1.42, SE = 0.29, z = -4.97) but not for conditional threats (29% vs. 20%, b = 0.52, SE = 0.27, z = 1.91). Pairwise comparisons with a Bonferroni correction on the regression path times showed a similar asymmetry such that there was a processing cost when a conditional promise mismatched the preceding verb meaning (t (18.95) = 4.90, p < .001) but not when a conditional threat mismatched the preceding verb (t (19.74) = 0.58, p = 1). This asymmetry also emerged on the Total Time measure such that there was a processing cost when a conditional promise mismatched the preceding verb meaning (t (17.90) = 3.99, p = .002) with no penalty when a conditional threat mismatched the preceding verb meaning (t (18.92) = 1.71, p = .208).

Discussion

The results of this experiment reveal an *asymmetric* pattern of effects emerging on the consequent region. On first pass regressions out (a measure of early disruption to reading), regression path times (a measure of intermediate processing) and total time (a measure that includes later processing) we found an *asymmetric* effect. This was driven by a processing cost when a conditional promise followed the verb "threaten". There was no similar penalty when a conditional threat followed the verb "promise". However, the lack of an effect in first pass reading times suggests that readers do not immediately slow down upon encountering a mismatch with the previous verb meaning. Instead, they initially appear go back to earlier in

the text and verify the mismatch, as shown by the effect on first pass regressions out. This opens the possibility that readers display an initial uncertainty regarding the mismatch. Only once the mismatch has been verified, through regressive eye movement, does it disrupt and continue to disrupt reading, as shown in the regression path and total reading time measures.

These results indicate that, as with the previous experiments by Haigh et al. (2011) and Wood et al. (2016), readers are able to take account of pragmatic scope information during reading. Importantly, this experiment demonstrates that readers are sensitive to pragmatic scope information during reading of the conditional consequent itself and not just on presentation of a subsequent anaphor (cf. Haigh et al., 2011; Wood et al., 2016). This is important as it provides the first evidence that pragmatic scope information influences processing *during* reading of the conditional itself and that this effect is not the result of strategic processing upon presentation of an anaphor presented *after* the conditional (cf. Wood et al., 2016).

The findings of this eye-tracking experiment also highlight a crucial difference to those reported in Haigh et al. (2014) where there was a disruption to processing whenever the prior context and conditional meaning mismatched. The asymmetric effect shown in the present experiment demonstrates that readers are able to take account of pragmatic scope information during processing of the conditional, alongside utility cues. Indeed, when taking into consideration the findings of Wood et al. (2016), pragmatic scope information may precede utility information.

Recent theoretical work looking at the comprehension of conditionals has looked at those cues which are used to correctly classify the pragmatic meaning of conditionals (e.g., as promises, threats, warnings and tips, Bonnefon, 2009; López-Rousseau & Ketelaar, 2004; 2006). Several studies have subsequently shown that these cues are used in the online comprehension of conditionals (Stewart et al., 2013; Haigh et al., 2014). Utility grid based

cues take account of only some aspects of the conditional meaning, namely who controls the consequent event and the polarity of the outcome of the conditional. In the experiment reported in this paper we have shown that other, more complex, pragmatic scope information also influences online conditional processing. Accessing pragmatic scope information requires the reader to consider the meaning of the conditional itself and how it can be used in a particular discourse context. Readers appear to be sensitive to the fact that a speaker can make use of the greater obligation carried out by promises in order to strengthen the utterance of a threat (Searle & Vanderveken, 1985). The findings above demonstrate that a complete account of how readers comprehend conditionals needs to consider the multiple sources of information (including pragmatic scope information) which can influence processing online, not just those cues which are derived from utility grids.

Our research is therefore in line with recent work within the experimental pragmatics field which has highlighted the need to investigate the importance of pragmatic information as part of people's comprehension of a speaker's intended meaning (Noveck & Reboul, 2008). We propose that using temporally sensitive measures, such as eye-tracking, to examine the comprehension of contextualised conditionals is one way in which this might be achieved. As shown in this paper, adopting such a strategy allows us to uncover those factors which play a role in understanding speakers intended meaning in promises and threats. This is important as it helps uncover when semantic, sentence based, and pragmatic, intended meaning based, information is utilised during reading. Given the widespread usage of inducements in language, where the speaker is intending to alter the addressee's behaviour (Searle, 1976), it would seem likely that the findings of research utilising this approach would have applications both in terms of understanding conditionals but in experimental pragmatics more generally.

Although we have outlined the most likely explanation for our results there is a possible alternative. This is the possibility that because promises can be linked to negative statements, such as threats, then the verb "promise" itself may have both positive and negative meanings. In this instance, the negative utility grid information in the conditional threat would not conflict with the verb "promise", which can encompass both positive and negative meanings, explaining the lack of reading disruption in this situation. This is similar to our argument of pragmatic scope. However, where we argue pragmatic scope is an additional pragmatic influence on the original positive utility grid because of prior experience, in this account the meaning of promises themselves is ambiguous with respect to polarity. However, this explanation seems unlikely given that previous research (cf. Searle, 1969; Gibbs & Delaney, 1987; Bernicot & Laval, 1996) has suggested that in both adults (Gibbs & Delaney, 1987) and children (Bernicot & Laval, 1996) for an utterance to be considered a "promise" it needs to be beneficial for the addressee. It seems more likely, therefore, that our results rather than contradicting these previous findings suggest that people's exposure to pragmatic factors, such as the use of reformulations of threats as promises ("that's not a threat, that's a promise"), means that during online reading a conditional threat can be referred to as a type of promise without disrupting reading. In short, we are suggesting that this pragmatic factor based upon speaker obligation indicates that people are more accepting of a flexible usage of the term "promise" than is suggested more formally (as in Bonnefon, 2009; Searle, 1969). As Mey (2001) pointed out the strongest indicator of a promise is the level to which it obligates the speaker. Whereas, by contrast, the importance of the positive nature of the promise for the addressee in determining whether something is judged to be a promise can be changed by pragmatic factors. In short as previous research has shown we would argue that the verb "promise" is likely to be

connected to a positive outcome for the addressee but that pragmatic factors may modulate this effect during online reading.

        Overall, these results provide evidence consistent with the notion that pragmatic scope information can be accessed during conditional processing. This is compatible with the view that pragmatic meaning based processing (involving sensitivity to the difference in flexibility between conditional promises and threats) is able to accommodate a conditional threat as a particular kind of promise, and can do so independently of (and alongside) the activation of utility grid based polarity information.

References

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language, 59*, 390-412.

Barr, D.J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language, 68*, 255–278.

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). lme4: Linear mixed-effects models using Eigen and S4. R package version 1.1-8. http://CRAN.R- project.org/package=lme4.

Bernicot, J., & Laval, V. (1996). Promises in French children: Comprehension and metapragmatic knowledge. *Journal of Pragmatics, 25*, 101-122.

Bonnefon, J.-F. (2009). A theory of utility conditionals: Paralogical reasoning from decision-theoretic leakage. *Psychological Review, 116*, 888-907.

Evans, J. St. B. T., & Over, D. E. (2004). *If.* Oxford: Oxford University Press.

Ferguson, H. J., & Sanford, A. J. (2008). Anomalies in real and counterfactual worlds: An eye-movement investigation. *Journal of Memory and Language*, *58*, 609-626.

Garrod, S., & Terras, M. (2000). The contribution of lexical and situational knowledge to resolving discourse roles: Bonding and resolution. *Journal of Memory and Language*, *42*, 526-544.

Gibbs, R. W., & Delaney, S. M. (1987). Pragmatic factors in making and understanding promises. *Discourse Processes, 10,* 107-126.

Haigh, M., Ferguson, H. J., & Stewart, A. J. (2014). An eye-tracking investigation into readers' sensitivity to expected versus actual utility in the comprehension of indicative conditionals. *The Quarterly Journal of Experimental Psychology, 67*, 166-185.

Holtgraves, T. (2008). Automatic intention recognition in conversation processing. Journal of *Memory and Language, 58*, 627-645.

Jaeger, T. F. (2008). Categorical Data Analysis: Away from ANOVAs (transformation or not) and towards Logit Mixed Models. *Journal of Memory and Language, 59*, 434–446.

Johnson-Laird, P. N., & Byrne, R. M. J. (2002). Conditionals: A theory of meaning, pragmatics, and inference. *Psychological Review, 109*, 646-678.

Lea, R. B., Kayser, P. A., Mulligan, E. J., & Myers, J. L. (2002). Do readers make inferences about conversational topics? *Memory & Cognition, 30*, 945-957.

Lea, R. B., Mulligan, E. J., & Walton, J. L. (2005). Accessing distant premise information. How memory feeds reasoning. *Journal of Experimental Psychology: Learning, Memory and Cognition, 31*, 387-395.

Lenth, R.V. & Hervé, M. (2015). lsmeans: Least-Squares Means. R package version 2.18. http://CRAN.R-project.org/package=lsmeans

López-Rousseau, A., & Ketelaar, T. (2004). "If...": Satisficing algorithms for mapping conditional statements onto social domains. *European Journal of Cognitive Psychology, 16*, 807-823.

Mey, J. L. (2001). *Pragmatics: An introduction* (2nd ed.). Oxford. Blackwell Publishing.

Noveck, I. A., & Reboul, A. (2008). Experimental pragmatics: A Gricean turn in the study of language. *Trends in Cognitive Sciences, 12*, 425–431.

Over, D., Douven, I., & Verbrugge, S. (2013). Scope ambiguities and conditionals. *Thinking & Reasoning, 19*, 284-307.

R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Sanford, A. J., Garrod, S., Lucas, A., & Henderson, R. (1983). Pronouns without explicit antecedents? *Journal of Semantics*, *2*, 303-318.

Searle, J. (1976). A classification of illocutionary acts. *Language in Society, 5*, 1-23.

Searle, J., & Vanderveken, D. (1985). *Foundations of Illocutionary Logic.* Cambridge: Cambridge University Press.

Stewart, A. J., Haigh, M., & Ferguson, H. J. (2013). Sensitivity to speaker control in the online comprehension of conditional tips and promises: an eye-tracking study. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 39*, 1022-1036.

Verbrugge, S., Dieussaert, K., Schaeken, W., & Van Belle, W. (2004). Promise is debt, threat another matter: The effect of credibility on the interpretation of conditional promises and threats. *Canadian Journal of Experimental Psychology, 58*, 106-112.

Wood, J., Haigh, M., & Stewart, A. J. (2016). "This isn't a promise, it's a threat": eye movements reveal semantic scope differences in conditional inducements. *Experimental Psychology. 63,* 89-97.

Wray, H., Wood, J., Haigh, M., & Stewart, A. J. (2016). Threats may be negative promises (but warnings are more than negative tips). *Journal of Cognitive Psychology, 28,* 593-600.

Appendix

Experimental items

Each item has four possible versions (a) promise (verb meaning), conditional promise; (b) threat (verb meaning), conditional promise; (c) threat (verb meaning), conditional threat & (d) promise (verb meaning), conditional threat. The words in parenthesis do not appear in the items when shown to participants.

1

Ian was at a builder's merchant to buy some paving slabs for a job. He approached the sales assistant intent on getting a good deal. She promised/threatened him "if you buy in bulk, then I'll give you our trade discount"(promise) / "if you only buy a small amount, then I'll stop your trade discount" (threat). This comment helped Ian to make his decision. He thought about it for a while and then placed his order.

2

It was a Friday night and Becky was desperate to get out of the house. She phoned her lazy boyfriend to try and pressure him to go out with her. He promised/threatened her "if you go to the pub, then I'll come with you."(promise) / "if you go the pub, then I'll break up with you." (threat) Now he had said this he could not undo it. They went through the same process most weekends.

3

Linda was at a party with her boyfriend to celebrate a friend's birthday. She was beginning to feel tired and told her boyfriend she was thinking about heading home. He promised/threatened her "if you go home early, then I'll come with you" (promise) / "if you go home early, then I'll go to parties on my own in future" (threat). These types of little comments showed the kind of relationship they had. Linda's boyfriend often made such statements.

4

Mary was halfway through her 12-month mobile phone contract and was unhappy with the service. She called her mobile phone provider and said she wanted to change networks. The customer service assistant promised/threatened her "If you stay with our network, then we'll give you 100 free texts every month." (promise) / "If you leave our network, then we'll take back your free phone." (threat) This was the kind of statement that might influence her decision. Although the salesperson was asking for her to make a decision Mary decided to think about it for a few days.

5

Gina was desperate to contact her boss outside office hours about an issue at work. She phoned him but he was a very busy man who didn't take kindly to being called at home. He promised/threatened her "if you come to my office first thing tomorrow, then I'll talk to you

at that time" (promise) / "if you phone me at home again, then you'll get the sack" (threat). Gina's boss's comment was all she had to get the problem sorted out. If she couldn't deal with it soon there would be serious implications at work.

6

Last night Perry and Liam borrowed their dad's car without asking. Unfortunately Perry managed to reverse the car into a garden wall and crack the rear bumper. In deciding what to do Liam promised/threatened Perry "if you tell dad, then I'll take equal responsibility" (promise) / "if you tell dad, then I'll tell him it was your fault" (threat). This left Perry feeling no better. The car was not even a year old.

7

Claire and Kim both needed to buy new outfits for their friend's wedding. The wedding was only two weeks away and neither of them had been shopping yet. Claire promised/threatened Kim "if you go shopping this Sunday, then I'll come with you" (promise) / "if you go shopping on Sunday without me, then I will ignore you at the wedding" (threat). This gave Kim some motivation to sort out her outfit with Claire. Kim always left things to the last minute.

8

Leanne and her friends were in their final year at university and wanted to go on holiday together. However, Leanne was short of money and so phoned her mum to see if she had any helpful ideas. Her mum promised/threatened her "if you do well in your exams, then I'll pay for the holiday" (promise) / "if you go on holiday instead of revising for your exams, then I'll stop your living allowance" (threat). Her mother's comment meant Leanne re-evaluated her plans. The rest of her friends were planning to book their flights and accommodation over the next few weeks.

9

Beth was preparing for her upcoming Physics exam. She had to decide whether her time would be spent revising in the library or attending the final physics lecture. The lecturer Dr Roberts had earlier promised/threatened that "if you miss the lecture, then I will send you the lecture notes" (promise) / "if you miss the lecture, then I will fail you" (threat). Dr Roberts usually kept his word so that helped Beth decide. The exam was only a week away and she didn't feel at all prepared.

10

John was in a meeting with his project supervisor at university. They were discussing the results of the study for which John was employed as a research assistant. John's supervisor promised/threatened him that "if the results are written by next week, then I will put you on the paper as an author" (promise) / "if the results are written later than next week, then I'll take you off the project" (threat). John decided based upon this statement that he would make sure the results were completed. He thought he would work on it over the weekend if necessary.

11

Eleanor was looking to book her summer holiday. She had visited the travel agent to try and find the best deal. The agent promised/threatened her "if your departure date is flexible, then we'll guarantee you the cheapest deal" (promise) / "if you depart in august, then we will charge you more" (threat). This meant that Eleanor went for that deal. She felt like she deserved a holiday as she hadn't been away in over a year.

12

Amanda was having relationship problems and she and her partner had been fighting. Her mum, Julie, had come over to see how she was. Her mum promised/threatened her "if you decide to stay with him, then I'll support you through this" (promise) / "if you decide to stay with him, then I'll tell your father he's been hitting you" (threat). Amanda knew her mum would keep her word. Her mum's interest showed that at least she cared about her.

13

Kevin and Craig shared a house together. Since they moved in Craig keeps forgetting to pay his share of the rent. On the way to work, Kevin promised/threatened Craig "if you forget the rent again, then I'll put your share in for now" (promise) / "if you forget the rent again, then I'll take you to court for your share" (threat). Kevin often said this which Craig appreciated that Kevin should not have to do. Craig felt bad that he was so bad at upholding his part of the tenancy.

14

It was Thursday evening and Alan was getting ready to leave the office. A few of his colleagues had invited him to the pub for drinks but he was feeling reluctant. His manager had earlier promised/threatened "if you come into work early again, then I'll give you an extra day's holiday" (promise) / "if you come to work hung over again, then I'll dock your wages" (threat). His manager rarely made statements like this. Alan knew that going drinking could easily lead to him being hung over and late the next morning.

15

Paul and Jonas were being interviewed by the police after brawling in the street. It was clear to the police officer they both felt guilty for causing such trouble. This led the police officer to promise/threaten "If you tell me what happened, then I'll let it go at that" (promise) / "If you both stay silent about what happened, then I'll arrest you both" (threat). The police officer's comment was all the encouragement they needed to explain why they had been fighting. Neither of them wanted to be in trouble with the police.

16

Robert had been diagnosed with diabetes over five years ago. He had to take tablets several times a day to manage the condition. However, one day his GP promised/threatened "If you continue to manage your diet so well, then I will reduce your medication" (promise) / "If you continue to ignore your diet, then I'll stop treating you" (threat). This statement made by his

GP convinced Robert to try to stick to the diet. Robert was fed up with having to always remember his medication at mealtimes.

17

Adam and Nancy had been going out for over a year and Adam wanted Nancy to move in with him. However, Nancy hated Adam's smoking and how her clothes smelt after being out with him. One night Nancy promised/threatened "If you give up smoking, then I will move in with you" (promise) / "If you keep on smoking, then I will break up with you" (threat). This made Adam realise how much she hated his smoking. He decided that perhaps it was a dirty habit.

18

Margaret had been having some problems trying to convince her fourteen year old daughter, Amy, to tidy her room. This was an ongoing battle on Margaret's part. Eventually Margaret promised/threatened Amy "If you keep your room tidy, then I'll increase your pocket money" (promise) / "If you keep leaving your room untidy, then I'll reduce your pocket money" (threat). This made Amy decide it might be best to tidy up. She thought that she would spend fifteen minutes each weekday after school just tidying up.

19

Andrea had been diagnosed with a mental illness several years ago. She had to see a social worker every month but disliked doing so. At her mental health review her social worker promised/threatened "If you keep your appointments with me, then I'll reduce them from monthly to every other month" (promise) / "If you keep avoiding your appointments with me, then I'll get you admitted to hospital for observation" (threat). This comment meant Andrea decided to keep her appointments from now on. She wanted as much freedom from supervision she could get.

20

Marcus had booked a table for his anniversary at his favourite restaurant, where he was a regular customer. However, upon arrival they found the table was double booked. Marcus promised/threatened the waiter "If you provide us with a table straight away, then I'll leave you a good tip" (promise) / "If you make us wait for a table, then I'll stop coming here to eat" (threat). With this statement as an incentive the waiter managed to find them a table. Marcus and his girlfriend were able to celebrate their anniversary after all.

21

James stood nervously at the bar waiting to be served. He had spent the last hour talking to his brother about how much he fancied the barmaid. His brother promised/threatened him "if you buy me a drink, then I'll find out if she's single" (promise) / "if you don't ask her out, then I'll ask her out myself" (threat). This kind of comment was characteristic of his brother. They had always behaved this way to one another.

22

George and Miriam are an elderly couple who generally share the chores. However, Miriam sometimes forgets to rinse the milk cartons out before putting them in the recycling box. George had earlier promised/threatened Miriam "if you forget to wash the milk cartons again, then I'll do it before I put the recycling out" (promise) / "if you forget to wash the milk cartons again, then I'll stop putting the recycling out" (threat). George always kept to his word about things like this. Since they had retired they spent more time arguing.

23

Maggie was 10 years old and loved playing the piano. She had lessons twice a week with a piano teacher but was stuck learning one piece. One day her piano teacher promised/threatened "If you get it right this time, then you can go early" (promise) / "If you get it wrong this time, then I'll give you extra homework" (threat). This was a strong incentive for Maggie as she wanted to play out with her friends. Maggie and her friends loved playing netball in the park.

24

John was a keen football player and a talented striker. However, he was sometimes very greedy with the ball and would not pass to other players. After one practice the coach promised/threatened "If you start passing the ball, then I'll put you on the team" (promise) / "If you keep being selfish with the ball, then I'll take you off the team" (threat). John realised from this comment that he would have to improve his passing. John was determined to make the team.

25

Ten year old Andrew and his dad were out clothes shopping. However, Andrew hated shopping and often caused a fuss whilst they were out. So, on this trip his dad promised/threatened "If you're good whilst we do the shopping, then I'll take you to the park after we get home" (promise) / "If you're naughty whilst we do the shopping, then I'll send you to bed once we get home" (threat). Andrew knew his dad would stick to this statement and so decided to behave. Andrew could be well behaved when necessary.

26

Molly and her more adventurous companion Jennifer were out in Blackpool. Molly was quite happy to just walk along the promenade but Jennifer was bored with this. So, Jennifer promised/threatened Molly "If you go on the rollercoaster with me, then I'll buy us both fish and chips" (promise) / "If all you're going to do is walk around, then I'll leave to do my own thing" (threat). Molly was still uncertain despite this comment by Jennifer. Molly liked to take her time making decisions.

27

Neil had to go swimming with school once a week. His instructor was trying to get him to do a width using breaststroke. His instructor promised/threatened "If you swim breaststroke for me, then I'll give you a gold star" (promise) / "If you just splash around again, then I'll make you get out" (threat). Neil's instructor generally kept his word so Neil decided to give it a go. Neil was not a bad swimmer but thought his own style was best.

28

Alison was a shy girl who often felt left out by Becky and the other girls at school. Alison decided to find out how the other girls felt about her by asking Becky if she could come next time. Becky promised/threatened her "If you come with us to watch the movie, then I'll let you share the popcorn" (promise) / "If you come with us to watch the movie, then I'll make you buy the popcorn" (threat). Alison was able to determine from this statement how Becky felt about her. Alison enjoyed eating popcorn at the cinema.

29

Andy was a contestant on a talent show. He was into the third round and really wanted to win. When he went on to sing the judge promised/threatened him "If you sing like you did in the last round, then I'll award you first prize" (promise) / "If you sing like you did in the last round, then I'll send you home empty-handed" (threat). This comment was enough to persuade Andy to give it his best. Andy had a lot of family watching and did not want to disappoint them.

30

Jack was eight years old with two elder sisters. Jack's sisters were teenagers and wanted their space. His eldest sister hated how Jack often wandered into her bedroom. In the end she promised/threatened Jack "If you stay out of my room, then I will stay out of yours" (promise) / "If you come into my room again, then I will make you sorry" (threat). Jack decided because of this that he would avoid his sister's room. Jack was too young to understand his sister's need for privacy.

31

Jason sometimes walked home from school after buying chocolate. On this occasion he saw a group of boys playing football in the park as he walked past. The largest boy approached Jason and promised/threatened "If you share your chocolate, then I'll let you play football" (promise) / "If you don't give me your chocolate, then I'll beat you up" (threat). This made Jason decide to give the boy his remaining chocolate. Jason did not really consider it a great loss as he was not that hungry.

32

Janet was a typical teenage girl who was fond of sweets, music and boys. As the eldest child she also often did jobs for her mum such as going to the shops. Janet's mum promised/threatened her one evening "If you go shopping for me, then I'll give you extra pocket money" (promise) / "If you stay out late again, then I'll ground you for a week" (threat). Janet's mum generally kept her word and so Janet decided to do as she asked. Janet was a good person who did not cause any trouble.

Table 1: *Example of the four experimental conditions. The region of interest is highlighted in bold and delimited by vertical bars.*

		Verb Meaning	
		Promise	Threat
Conditional Meaning	Promise	Last night Perry and Liam borrowed their dad's car without asking. Unfortunately Perry managed to reverse the car into a garden wall and crack the rear bumper. In deciding what to do Liam promised Perry "if you tell dad,| **then I'll take equal responsibility".** CRITICAL REGION | This left Perry feeling no better. The car was not even a year old.	Last night Perry and Liam borrowed their dad's car without asking. Unfortunately Perry managed to reverse the car into a garden wall and crack the rear bumper. In deciding what to do Liam threatened Perry "if you tell dad,| **then I'll take equal responsibility".** CRITICAL REGION | This left Perry feeling no better. The car was not even a year old.
	Threat	Last night Perry and Liam borrowed their dad's car without asking. Unfortunately Perry managed to reverse the car into a garden wall and crack the rear bumper. In deciding what to do Liam promised Perry "if you tell dad,| **then I'll tell him it was your fault".** CRITICAL REGION | This left Perry feeling no better. The car was not even a year old.	Last night Perry and Liam borrowed their dad's car without asking. Unfortunately Perry managed to reverse the car into a garden wall and crack the rear bumper. In deciding what to do Liam threatened Perry "if you tell dad,| **then I'll tell him it was your fault".** CRITICAL REGION | This left Perry feeling no better. The car was not even a year old.

Table 2: *Mean reading times and regressions (averaged over subjects) to each region (standard errors in parenthesis).*

Verb Meaning	Conditional Meaning	First-pass (msec.)	First-pass Regressions Out %	Regression Path (msec.)	Total Time (msec.)
Consequent Region					
Promise	Promise	1,001 (57)	16.34 (2.45)	1,175 (64)	1,124 (64)
Promise	Threat	1,004 (63)	28.94 (3.24)	1,344 (76)	1,230 (73)
Threat	Promise	1,036 (71)	39.72 (3.93)	1,604 (85)	1,340 (77)
Threat	Threat	994 (63)	20.31 (2.32)	1,291 (69)	1,134 (66)

Table 3: *Results of the linear mixed models for each measure of interest. Significant effects are highlighted in bold.*

	Duration measures									Binomial measure					
	First Pass			Regression Path			Total Time			Regressions Out – by subjects			Regressions Out – by items		
	b	SE	*t*	*b*	SE	*t*	*b*	SE	*t*	*b*	SE	*z*	*b*	SE	*z*
Consequent Region															
Intercept	**1007.92**	**75.29**	**13.39**	**1352.73**	**80.61**	**16.78**	**1207.2**	**85.43**	**14.13**	**-1.13**	**0.12**	**-9.74**	**-1.14**	**0.12**	**-9.59**
Conditional Meaning	-13.9	31.37	-0.44	**-188.49**	**63.52**	**-2.97**	-60.46	62.84	-1.59	**-0.39**	**0.16**	**-2.48**	**-0.42**	**0.16**	**-2.64**
Verb Meaning	23.35	66.08	0.35	75.57	95.69	0.79	51.28	87.88	0.58	0.12	0.15	0.8	0.11	0.15	0.74
Interaction	-42.67	79.54	-0.54	**-481.59**	**123.77**	**-3.89**	**-312.04**	**79.55**	**-3.92**	**-1.75**	**0.3**	**-5.8**	**-1.77**	**0.3**	**-5.81**